How this investigation fits within the “Concept and Lesson Map”:

**Overview for Unit 2: Liquids**

This investigation allows students to observe the properties of a second state of matter, liquid. They investigate the characteristics of liquids in containers. Students develop ideas and definitions of solids and liquids based on their observations and comparisons.

Overarching question(s) for this whole investigation:

* What are the observable properties of different liquids?

**Attending to “How People Learn”**

How People Learn Key Finding #1: Preconceptions

Eliciting Student Ideas:

* Administer the probe, “Investigation 2: Liquids Formative Pre-Assessment Student Sheet” for uncovering student prior knowledge of liquids before beginning Investigation 2. It is suggested that the materials for this probe be set up as a station with adult literacy support.

Common Student Preconceptions:

* “children appear to identify a liquid as a material that is ‘runny’ or ‘can be poured’. Consequently, their view of liquids includes materials, such as powders.” (Driver, 2002)
* “because in a child’s view, the exemplary liquid is water, all liquids may be regarded as ‘watery’, or ‘made of water’, or ‘containing water’.” (Driver, 2002)
* “some children found the task of classifying more viscous liquids such as paste, honey and tomato sauce to be more problematic than classifying ‘runny’ ones.” (Driver, 2002)

How People Learn Key Finding #2: Facts/Concepts/Knowledge

WA State Content Standards “Science Domains” (EALR 4)

* K-1 PS2A Liquids take the shape of the part of the container they occupy.

WA State Science Standards “Crosscutting Concepts and Abilities” (EALRs 1-3)

* K-1 INQA Scientific investigations involve asking and trying to answer a question about the natural world by making and recording observations.
* K-1 INQC Scientists develop explanations, using recorded observations (evidence).
* K-1 INQD Scientists report on their investigations to other scientists, using drawings and words.

Key Understandings For the Teacher:

* Like gases, liquids have no fixed shape, but they differ from gases in having a fixed volume. At the atomic level liquids behave something like a bowl full of marbles. Like marbles, the liquid molecules slide over each other, shifting while retaining their available volume. Individual molecules do not stick tightly together, however, so the entire mass is free to change shape (or spill on the floor). (Science Matters, 1991)
* Mastery of suggested vocabulary associated with this investigation should not be expected by teachers. Exposure should be the focus.
* See “Background for the Teacher” Investigation 2: Liquids folio, pg. 4 for a description of the science concepts introduced in this investigation.

How People Learn Key Finding #3: Metacognition

Metacognition: How did my thinking change? What caused the change? How did I come to believe this?

After completing Investigation 2, students should complete the ”Liquids Formative Post Assessment Student Sheet”, then review their initial ideas from the beginning of the investigation and reflect on how their ideas have changed. Students will need support for this kind of thinking, explicitly connecting back to their preconceptions and what events may have brought about those changes. The scientific words transparent, translucent, and viscous have been added to the post assessment. Even though they now have exposure to this vocabulary, it should not be assumed that all students will have the understanding to correctly match these concepts with the liquids that exhibit the property. Like the pre-assessment, containers of each liquid and solid on the student sheet should be accessible for students to observe. Provide a flashlight for students to have access to during the task.

**Suggested Assessments for Student Understanding:**

There are opportunities to assess student understanding of the properties of liquids as they work at the liquids centers. Some questions to ask as you observe students working could be:

Part 1: Liquids in Bottles (see FOSS folio pg. 13)

* Are students using observation to identify more than one property of a liquid?
* Are students comparing the different liquids and their properties? Which are similar? Which are different?

Part 3: Liquid Level (see FOSS folio pg. 25)

* Are students noticing that the liquids take the shape of the container?
* What do they notice about the top of the liquids as they rotate?

**Additional Information**

Materials and Student Management

* The teacher should model and use the word PROPERTIES with students when observing the characteristics of liquids. The idea of properties will continue to be developed in grades 2, 3, and beyond. Students will also be introduced to scientific vocabulary when examining liquids, including viscous, translucent, and transparent. While one can make a case for early and on-going exposure to advanced scientific vocabulary, it should not be the emphasis of the investigation. It is therefore suggested that the Part 2 card games, Memory and Go Fish be skipped and instead replaced with more time for hands-on exploration and observation. Consider playing a “guess my rule” game similar to the one from Investigation 1, part 2.
* Consider adding a small flashlight to the kit to identify “translucent” liquids like non-fat milk.
* In parts 1 and 3 of this investigation FOSS suggests student pairs work at centers (stations). Teachers may choose to modify how the centers are organized. One idea is to have one FOSS liquid station as part of other academic stations where students are more independent. Students should be allowed to have the suggested “free exploration” time to interact and observe the liquids prior to focusing students on their observations. It is suggested that a whole class discussion take place post center experience to allow students to describe their ideas about the properties of the different liquids. Students should have access to the set of liquids during the discussion.
* When science is being conducted at a station and a parent or other helper is monitoring the activity, be sure they are clear about the *purpose* of the station; not just the steps to take the children through. It will help them view the station as a learning experience, rather than an activity to be completed. (When at all possible, the classroom teacher should be leading the stations.
* A flashlight could be a helpful tool at the liquid stations for students to observe light passing through transparent and translucent liquids.
* The FOSS summative end of the unit written assessment does not match the learning goals of the unit. It is suggested that this not be given to students. These goals will be addressed in the FOSS Water kit at third grade.

Timing Considerations